Claims

[c1] 1. A data reading apparatus for reading data from an optical storage device, comprising:
a light source that emits light and illuminate a section of the optical storage device; and
a first image sensor for capturing a data image reflected from the illuminated section of the optical storage device.

[c2] 2. The data reading apparatus of claim 1, wherein the first image sensor has a length intermediate between the radius and diameter of the optical storage device if the optical storage device has a circular profile.

[c3] 3. The data reading apparatus of claim 1, wherein the first image sensor has a length intermediate between the shortest side and the longest vertex line if the optical storage device has a polygonal profile.

[c4] 4. The data reading apparatus of claim 1, wherein the first image sensor includes a linear image sensor.

[c5] 5. The data reading apparatus of claim 4, wherein the linear image sensor is selected from a group consisting of charge-coupled device, contact image sensor and a CMOS sensor.

[c6] 6. The data reading apparatus of claim 4, wherein the linear image sensor includes a staggered image sensor.

[c7] 7. The data reading apparatus of claim 1, wherein the first image sensor includes an area image sensor.

[c8] 8. The data reading apparatus of claim 7, wherein the area image sensor is selected from a group consisting of an area charge-coupled device and an area CMOS sensor.

[c9] 9. The data reading apparatus of claim 7, wherein the first image sensor has a size comparable to the optical storage device.

[c10] 10. The data reading apparatus of claim 1, wherein the first image sensor

includes a plurality of image-sensing rows.

[c11] 11. The data reading apparatus of claim 1, wherein the apparatus further includes an image processor for receiving the image and converting the image into digital data.

[c12] 12. The data reading apparatus of claim 1, wherein the plurality of sensing cells within the first image sensor has at least two different dimensions.

[c13] 13. The data reading apparatus of claim 12, wherein the sensing cells in the outer region of the optical storage device has a dimension greater than the sensing cells in the inner region of the optical storage device.

[c14] 14. The data reading apparatus of claim 1, wherein the apparatus further includes a second image sensor having a focal plane at a different level from the first image sensor.

[c15] 15. The data reading apparatus of claim 14, wherein length of at least one of the two image sensors is intermediate between the radius and diameter of the optical storage device if the optical storage device has a circular profile.

[c16] 16. The data reading apparatus of claim 14, wherein length of at least one of the two image sensors is intermediate between the shortest edge and the longest vertex line if the optical storage device has a polygonal profile.

[c17] 17. The data reading apparatus of claim 14, wherein at least one of the two image sensors is a linear image sensor.

[c18] 18. The data reading apparatus of claim 17, wherein the linear image sensor is selected from a group consisting of charge-coupled device, contact image sensor and CMOS sensor.

[c19] 19. The data reading apparatus of claim 17, wherein the linear image sensor includes a staggered image sensor.

[c20] 20. The data reading apparatus of claim 14, wherein the first image sensor includes an area image sensor.

[c21] 21. The data reading apparatus of claim 20, wherein the area image sensor is selected from a group consisting of an area charge-coupled device and an area CMOS sensor.

[c22] 22. The data reading apparatus of claim 14, wherein at least one of the two image sensors includes a plurality of image-sensing rows.

[c23] 23. The data reading apparatus of claim 14, wherein the apparatus further includes an image processor for receiving the image and converting the image into digital data.

[c24] 24. The data reading apparatus of claim 14, wherein the plurality of sensing cells within the first image sensor and the second image sensor has at least two different dimensions.

[c25] 25. The data reading apparatus of claim 24, wherein the sensing cells in the inner region of the optical storage device has a dimension greater than the sensing cells in the outer region of the optical storage device.

[c26] 26. The data reading apparatus of claim 1, wherein the optical storage device is selected from a group consisting of compact disk and multifunctional digital versatile disk.

[c27] 27. The data reading apparatus of claim 1, wherein the light source also illuminates regions outside the reading section of the optical storage device.

[c28] 28. The data reading apparatus of claim 1, wherein the light source is positioned away from any one of the image sensors.

[c29] 29. The data reading apparatus of claim 1, wherein the light source is positioned close to any one of the image sensors.

[c30] 30. The data reading apparatus of claim 1, wherein the image is the light obtained from the surface of the optical storage device after light emitted from the light source is reflected.

[c31] 31. The data reading apparatus of claim 1, wherein the image is the light obtained after light emitted from the light source passes through the optical

storage device.

[c32] 32. A method of operating a data reading apparatus, wherein the data reading apparatus uses an image sensor to capture light reflected from an optical storage device when illuminated by a light source, the operating method comprising the steps of:
turning the light source on; and
operating the image sensor, the light source and the optical storage device so that the image sensor is able to capture an image from a particular a read-out section.

[c33] 33. The method of claim 32, wherein the image sensor has a capturing range equal to a region containing a plurality of data points on the optical storage device.

[c34] 34. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the optical storage device; and
rotating the image sensor and the light source.

[c35] 35. The method of claim 34, wherein the image sensor and the light source rotate in a clockwise direction.

[c36] 36. The method of claim 34, wherein the image sensor and the light source rotate in an anti-clockwise direction.

[c37] 37. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the optical storage device; and
moving the image sensor and the light source linearly.

[c38] 38. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the light source and the image sensor; and
rotating the optical storage device.

[c39] 39. The method of claim 38, wherein the optical storage device rotates in a

clockwise direction.

[c40] 40. The method of claim 38, wherein the optical storage device rotates in an anti-clockwise direction.

[c41] 41. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the light source and the image sensor; and
moving the optical storage device linearly.

[c42] 42. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the light source; and
rotating the image sensor and the optical storage device.

[c43] 43. The method of claim 42, wherein the image sensor and the optical storage device rotate in a clockwise direction.

[c44] 44. The method of claim 42, wherein the image sensor and the optical storage device rotate in an anti-clockwise direction.

[c45] 45. The method of claim 42, wherein the image sensor rotates in a clockwise direction and the optical storage device rotates in an anti-clockwise direction.

[c46] 46. The method of claim 42, wherein the image sensor rotates in an anti-clockwise direction and the optical storage device rotates in a clockwise direction.

[c47] 47. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the light source; and
moving the image sensor and the optical storage device linearly.

[c48] 48. The method of claim 47, wherein the image sensor and the optical storage device move in the same direction.

[c49] 49. The method of claim 47, wherein the image sensor and the optical storage device move in opposite direction.

[c50] 50. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the image sensor and the optical storage device; and
rotating the light source.

[c51] 51. The method of claim 50, wherein the light source rotates in a clockwise direction.

[c52] 52. The method of claim 50, wherein the light source rotates in an anti-clockwise direction.

[c53] 53. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the image sensor and the optical storage device; and
moving the light source linearly.

[c54] 54. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the light source and the optical storage device; and
rotating the image sensor.

[c55] 55. The method of claim 54, wherein the image sensor rotates in a clockwise direction.

[c56] 56. The method of claim 54, wherein the image sensor rotates in an anti-clockwise direction.

[c57] 57. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the light source and the optical storage device; and
moving the image sensor linearly.

[c58] 58. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the image sensor; and
rotating the light source and the optical storage device.

[c59] 59. The method of claim 58, wherein the light source and the optical storage device rotate in a clockwise direction.

[c60] 60. The method of claim 58, wherein the light source and the optical storage device rotate in an anti-clockwise direction.

[c61] 61. The method of claim 58, wherein the light source rotates in a clockwise direction and the optical storage device rotates in an anti-clockwise direction.

[c62] 62. The method of claim 58, wherein the light source rotates in an anti-clockwise direction and the optical storage device rotates in a clockwise direction.

[c63] 63. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes the following sub-steps:
fixing the image sensor; and
moving the light source and the optical storage device linearly.

[c64] 64. The method of claim 63, wherein the light source and the optical storage device moves in the same direction.

[c65] 65. The method of claim 63, wherein the light source and the optical storage device moves in opposite directions.

[c66] 66. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes rotating the image sensor, the light source and the optical storage device concurrently.

[c67] 67. The method of claim 66, wherein the image sensor, the light source and the optical storage device rotate in a clockwise direction.

[c68] 68. The method of claim 66, wherein the image sensor, the light source and the optical storage device rotate in an anti-clockwise direction.

[c69] 69. The method of claim 66, wherein at least one among the image sensor, the light source and the optical storage device rotates in a clockwise direction while the remaining two rotates in an anti-clockwise direction.

[c70] 70. The method of claim 66, wherein at least one among the image sensor, the light source and the optical storage device rotates in an anti-clockwise direction while the remaining two rotates in a clockwise direction.

[c71] 71. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes moving the image sensor, the light source and the optical storage device linearly and concurrently.

[c72] 72. The method of claim 71, wherein the image sensor, the light source and the optical storage device move in the same direction.

[c73] 73. The method of claim 71, wherein any one among the image sensor, the light source and the optical storage device and the remaining two move in opposite direction.

[c74] 74. The method of claim 32, wherein the step of operating the image sensor, the light source and the optical storage device includes fixing the image sensor, the light source and the optical storage device.

[c75] 75. The method of claim 32, wherein light emitted from the light source passes through the optical storage device.

[c76] 76. The method of claim 32, wherein the optical storage device reflects light emitted from the light source.